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Willow Planting for Riparian Habitat Improvement

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WILLOW PLANTING FOR RIPARIAN HABITAT IMPROVEMENT

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INTRODUCTION

Riparian zones are, without doubt, one of the most important and sensitive of all habitats on public lands. They provide a variety of habitat components that are essential to many species of wildlife. Because of the limited acreages, these areas are extremely valuable for producing and maintaining biotic diversity (Hubbard, 1977). In terms of value to wildlife, riparian zones receive significantly more use per unit area than any other vegetative type (Anderson and Ohmart, 1977; Kelly et al., 1975; Thomas et al., 1979). Conflicts in managing for multiple uses are inherent in riparian areas for several reasons. Water, the primary resource promoting results in riparian community development, is perhaps the major causative agent which results in numerous, and often conflicting uses. Both livestock and most wildlife species are dependent upon water, and recreationists are attracted to these areas for hiking, camping, bird- watching, fishing and aesthetics. In areas where livestock graze, there is a tendency for the animals to use riparian areas for feeding, resting and as travel lanes, thus increasing the impacts to soil and vegetation (Stoddart and Smith, 1955).

It is obvious to even the most casual observer that riparian areas in good ecological condition provide a "better" place to live for wildlife and a much more aesthetically pleasing place to recreate for man. Land managers have, in recent years, recognized these facts, and are beginning to increase management efforts to restore these areas to an acceptable condition.

This report is designed for field personnel who are interested in employing willow (*Salix* spp.) planting as a technique for riparian habitat improvement. While other methods are available which utilize seedlings or tube packs, the

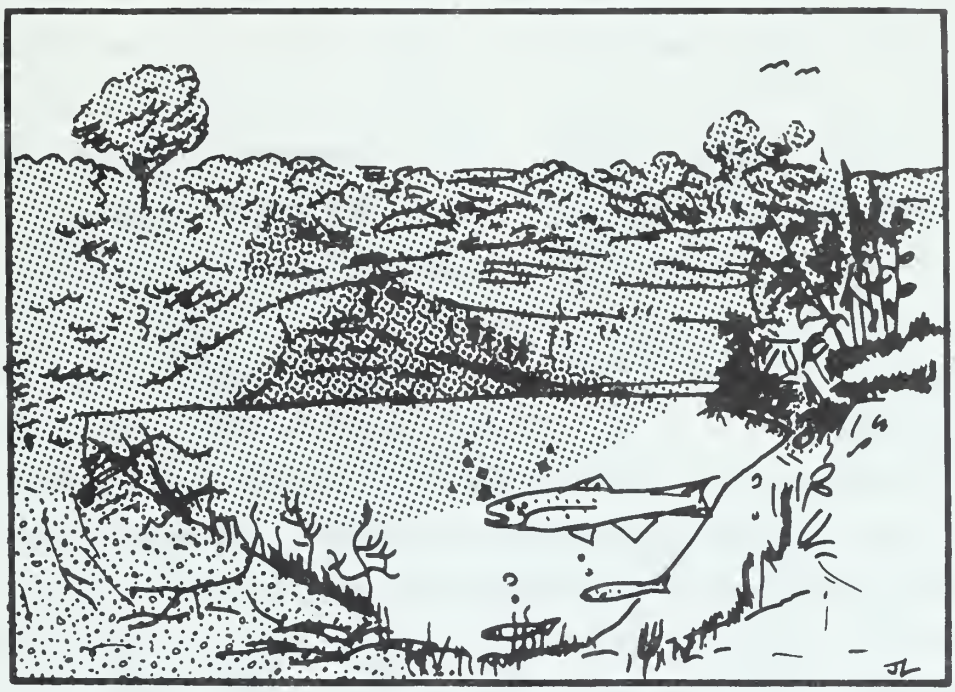
technique discussed here will only deal with vegetative cuttings of willows because they are, for many areas, the easiest to obtain, lowest in cost, usually locally acclimated, and produce a good benefit/cost ratio for the project.

Willow planting, using stem cuttings, has been recognized as a valuable tool for restoring riparian habitat condition. (Nelson et al., 1978; U.S.D.A. Forest Service, 1969). This technique is one of several available for riparian habitat improvement, but is particularly valuable because of its low cost. In addition, it requires only a minimal amount of tools and supplies (Appendix 1 and 2). Willow planting is desirable since a rapid response is usually obtained which benefits a large number of wildlife species including several birds that utilize mature willows for nesting, feeding, roosting and for cover during inclement weather (Thomas et al., 1979; McCluskey et al., 1982; Martin et al., 1951).

Aquatic and terrestrial mammals such as beaver (Castor canadensis), muskrat (Odontra zibethica), mule deer (Odocoileus hemionus), and moose (Alces alces) obtain substantial quantities of food from willows (Martin et al., 1951). In areas where dense stands are dominant, willows are used as hiding and thermal cover by mule deer and are cut by beaver for construction of dams and lodges. Some of the most important values of willow stands, however, are indirect benefits derived by aquatic organisms, particularly salmonid fishes. Well developed stands of willows provide both direct and indirect cover to fish. Overhanging branches provide direct cover, while the shade from tall plants provide indirect cover, since the fish are camouflaged by shaded waters. As the root masses become developed, streambanks are stabilized which allows moderate undercutting. These undercuts are favorite hiding and resting areas for fish

(Figure 1). On smaller streams, which characterize many streams in the intermountain west, fish are often adapted to this habitat edge (Platts, 1981).

FIGURE 1. Stabilized streambanks with moderate undercutting provide hiding and resting cover for fish.



Productive willow stands also play a key role in regulating stream temperatures by filtering solar energy. This helps maintain lower stream temperatures required by most salmonid fishes (Reiser and Bjornn, 1979). As an example, Figure 2 represents daily temperatures recorded in two similar streams in northern Utah during the month of May. Big Creek has less than 10 percent willow cover along its banks in the study area, while Donner Creek has approximately 90 percent of its streambanks covered with mature willow and other deciduous tree and shrub species. Only minor daily temperature fluctuations

were observed in Donner Creek, while Big Creek experienced large changes during the same period. The difference is attributed largely to streambank cover.

In addition to controlling stream temperature fluctuations, willow stands also contribute substantial quantities of terrestrial insects which form a major component of food items eaten by trout (Mundie, 1969; Meehan, et al. 1977; Platts, 1981). Detritus formed from leaves of willows which have fallen into the stream also play an important role as a food source for aquatic invertebrates which in turn are eaten by several fish species (Reiser and Bjornn, 1979).

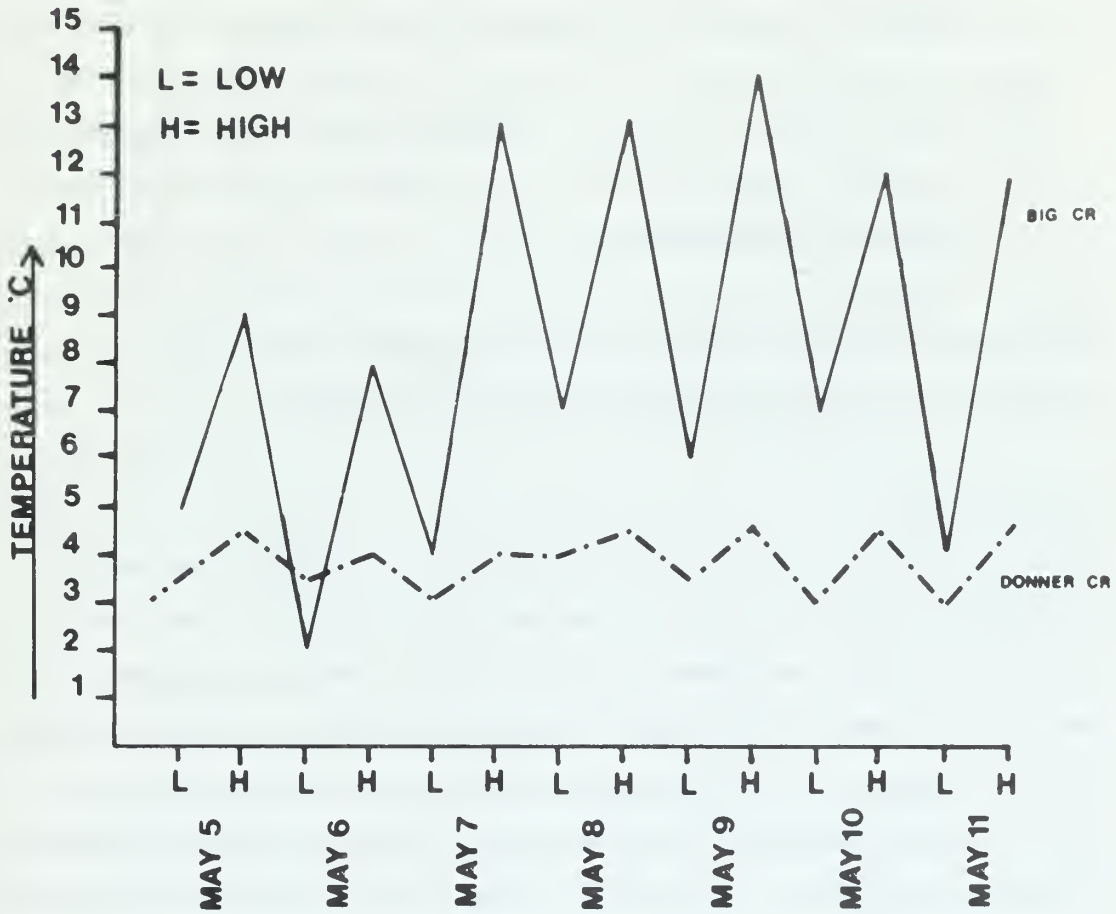
STREAM EVALUATION

This technique is one of several available for riparian habitat improvement. It should not be considered applicable for all streams. A thorough evaluation of stream habitats should be conducted prior to proceeding with this technique. Guidelines for conducting evaluations are outlined in Bureau of Land Management (BLM) Manual 6671, BLM Utah Manual Supplement 6671, and BLM Technical Note, TN-283.

The following are general guidelines which should be considered prior to initiating a willow planting project. The streambank:

a. Should have potential for willow production (willow stands or remnants that are visible and identifiable to species at or near the project site);

FIGURE 2. Comparisons of daily stream temperatures between Big Creek, Rich County; and Donner Creek, Box Elder County, Utah 1981.



b. Should have less than 60 percent willow or similar tree or shrub canopy coverage (Oregon/Washington Interagency Wildlife Committee, 1979);

c. Should show obvious signs of active erosion along more than 20 percent of the stream channel (Oregon/Washington Interagency Wildlife Committee, 1979);

d. Should contain less than 50 percent of the optimum instream cover, including overhanging bank vegetation. Optimum is defined as the site potential for natural or introduced vegetation; and

e. Should have obvious potential fisheries or other wildlife habitat improvement capabilities which can be enhanced through establishment of permanent willow cover.

If the project fits these or other management objectives, then serious consideration should be given to initiating willow planting.

PLANTING STOCK

Prior to initiating a willow planting project, it is important to assess the availability of planting stock. Willows are a diversified plant group which exhibit a variety of requirements for soil moisture, nutrients, depth and texture. Some species are adapted to non-oxygenated water while others require free-flowing water. In addition, there are species which are adapted to periodic flooding while others require constant moisture throughout the entire growing season (Winward, 1982, personal communication). For these reasons, it is critical that the willow species being planted match their environmental requirements. As a general rule, willows obtained within the same drainage as the project is located are best. In rarer cases, willow stocks have been totally eliminated, thus necessitating close examination of alternative sites or sources. If choosing stock from sites other than the planting area, it is important to consider the environmental conditions and match them to the extent possible.

Another alternative is to examine nursery stocks from State, Federal, or commercial sources. Most western states have a variety of sources to choose from; however, the number of willow varieties are frequently limited and may not fit the project needs (Appendix 3). Again, it is important to match the site characteristics to the species planted.

If the project leader decides suitable willow stocks are available in the vicinity of the project, they should be obtained as close to the project area as possible. This minimizes transportation costs and handling induced stress, thus increasing the probability of success. Large vigorous growing plants should be selected over very young or old stocks. Generally, cutting should take place in early spring (March, April, or May) prior to noticeable bud swelling. Cutting in the fall after leaf-drop is also possible if nursery propagation is desired and is available. Hudak (1982) reports that cuttings can be rooted in buckets filled with water containing fertilizer and rooting hormone mixed in solution. This technique merits more attention, since planting rooted stock generally increases survival (Monsen, 1982, personal communication). Other authors have reported good rooting success in willows cut later in spring after twig elongation and flowering (Everett et al., 1978). However, our experience and other's indicates this alternative should only be done under field conditions where soil moisture is not limiting (Meeuwieg, 1981, personal communication). For practical purposes, it is probably best to plan the majority of planting projects during early spring prior to the breaking of dormancy.

CUTTING

A. Make initial cuttings from one to three year old stems. Long straight "whips" are ideal since they indicate a healthy growing plant. Each cut should be made with a sharp knife or pruning shears at approximately a 45 degree angle to the stem (Figure 3).

FIGURE 3. Make initial stem cuttings from larger, one to three year old willow stems.

FIGURE 4. Re-cut initial cuttings into shorter lengths, varying in size from 12 to 24 inches in length, depending upon the desired planting depth.

FIGURE 5. Cut the terminal end horizontally and the basal end at a 45 degree angle to aid in keeping the cuttings oriented correctly and facilitate planting.

FIGURE 6. Group cuttings into bundles of 25 to 50 each with basal ends all oriented in the same direction.

B. Re-cut these cuttings into shorter lengths varying from 12 to 24 inches each (Figure 4). All lateral branches and the terminal end of branches should be removed. Failure to do so will result in excessive leafing and flower production. The terminal end, which will remain exposed after planting, should be cut horizontally while the basal end (portion to be planted) should have a 45 degree cut (Figure 5). This step aids in orienting the stems for planting. The basal end which has the angled cut facilitates insertion into the ground and helps reduce damage to stem tissue.

C. Group these cuttings into bundles of 25 to 50 each with the basal ends all oriented in the same direction (Figure 6). Place the bundled cuttings into a small bucket of water, wet peat moss or sawdust to keep the cuttings until you are ready to treat the stems as outlined in Step D.

D. Following Step C, it is suggested you treat the cutting tips with a combination growth hormone and fungicide (Figure 7) substances such as Rootone[1] which contain indolebutyric acid, napthaleneacetic acid, or napthaleneacetamide. Most of these, or similar products, are commercially available at garden centers, or forestry or nursery supply outlets that handle plants or plant care products. This step aids in survival by inhibiting fungus development, and also stimulates root development.

1 The use of trade, firm, or corporation names in this publication is for the information and convenience of the reader. Such use does not constitute an official endorsement or approval by the U.S. Department of Interior or U.S. Department of Agriculture of any product or service to the exclusion of others which may be suitable.

FIGURE 7. Treat the basal ends of grouped cuttings with a combination growth hormone and fungicide.

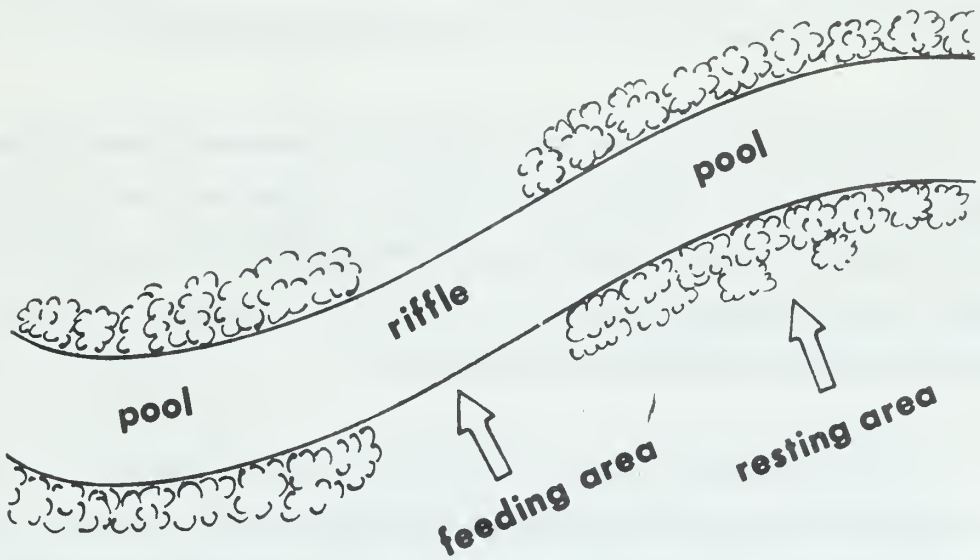
PLANTING

Following hormone and fungicide treatment, it is recommended that the bundled cuttings be allowed to callus or dry for 30 minutes to an hour in open air. This minimizes loss of the rooting hormone through handling and planting, which increases the chances of a successful planting.

When the rooting hormone has satisfactorily callused, begin planting by pushing the cuttings into the soil by hand so that approximately one-fourth of the stem remains exposed. Spacing, planting depth and distance from the stream will vary by area, species used and overall objectives. Generally, a six to ten foot spacing is recommended on long stretches of riparian habitat. Areas which show signs of severe erosion should be planted more densely. In some cases where active bank cutting is taking place, it may be desirable to plant two or three rows of cuttings parallel to one another as backup in the event some are lost due to bank sloughing. Depending on objectives, it may also be desirable to leave gaps at selected areas along the stream to create more diversity and allow solar penetration to increase production of macroinvertebrate populations (Figure 8). Gaps of this sort should be located along selected riffle areas where production rates for macroinvertebrates are greatest (Barber and Kever, 1973). Where possible, the amount of area left open should not exceed 25 percent of the stream length in order to maintain summer water temperatures below 21.1°C (70°F.) (Bowers et al., 1979)

If it becomes necessary to store cuttings for short periods, they should be wrapped in moist burlap or stored in plastic garbage bags with moist newsprint, sawdust, or peat moss. The cuttings should be kept out of direct sunlight until ready to plant. If, for some reason, the basal end becomes dry to the point that it becomes sealed, then make a fresh cut approximately one inch above the

FIGURE 8. Willow plantings spaced to achieve a desirable combination of leave and cover areas.



original cut and retreat with the rooting hormone substance. Under normal conditions, drying would not occur for several hours.

If the soil is moist, little to no site preparation is necessary. The cuttings can usually be inserted by hand. If the ground is compacted or extremely dry, it may be necessary to break the surface with a shovel, hazel hoe, or modified "dibble bar" (Hudak, 1982). If this is necessary, make an opening deep enough to insert the cutting to its desired depth, insert the cutting, and tamp the hole with your foot before moving to the next site. Hudak (1982a) redesigned the standard tree planting "dibble bar" in an effort to increase planting depth. He reports that using this tool enhances planting success.

PROJECT MAINTENANCE

Proper maintenance and management of any project should be given the highest priority. This will reduce long-term costs and increase the benefit/cost value of a specific project over time. The following protection measures should be taken in riparian habitats which have received willow plantings:

a. Fencing, or some other form of seedling protection (Crouch, 1978), is almost a necessity to protect young willows until established. In some areas it may be desirable to develop grazing management systems which incorporate the riparian zone as a separate pasture which could be periodically rested to protect or enhance all streambank vegetation.

b. Protect riparian vegetation from broad herbicide treatments. It may be necessary to conduct site-specific herbicide applications to control noxious weeds within riparian exclosures. If so, applications should be done under tight controls so desirable shrubs and trees are protected from treatment.

c. Rodent or other pest control may be required to protect willows until established. Rabbits (Sylvilagus), hares (Lepus), and beavers (Castor canadensis) are frequently attracted to young willow stands and can inflict serious damage if not closely monitored.

d. Limit human use of project areas if possible, since their activities can be quite destructive. Do not construct recreational facilities or trails near project areas, as these tend to concentrate people. Also, interpretive signs should be erected explaining the needs and management objectives of riparian habitat restoration projects.

Willow establishment along riparian zones is an effective management tool that yields positive benefits to a number of fish and wildlife species, as well as providing necessary protection to the fragile stream environment. Willow planting should be considered as one of many management tools, and not as an end in itself to riparian zone management.

Willow planting projects utilizing this technique on the Salt Lake District have proven to be successful. If methodologies outlined are followed, an establishment rate of at least 80 percent could be predicted.

Factors contributing to the satisfactory results experienced at the Salt Lake District include:

a. An adequate evaluation of existing stream and bank conditions to determine stability.

b. Utilization of local willow stocks from similar soil and habitat types which improve survivability of cuttings.

c. Cuttings planted in the spring allow root development prior to dormancy.

d. Use of pre-emergent stock.

e. Larger, one to three year old stems with side branches removed were used.

f. Treatment with rooting hormone.

g. A methodology easily taught to non-skilled help, such as boy scouts or other volunteer groups. This means a considerable savings in time and wages for permanent office staff and, therefore, makes the action appealing to management.

h. Little time lapse between cutting, treating and planting.

i. Closely matching the environmental requirements of the species being used to local conditions.

j. Adequate protection from wildlife and livestock grazing. Perhaps the most essential factor in assuring willow establishment.

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APPENDIX 1

Equipment and supplies needed to plant willow cuttings along both side of one mile of stream utilizing a 10 foot spacing distance.

Supplies

Pruning shears

Heavy duty pruning shears

Burlap or plastic bags

Plastic buckets (2 gallon)

Plastic buckets (1/2 gallon)

Twine

Shovels or hazel hoes

Modified planting bars

Rooting hormone (7 ounces)

Willow cuttings (1,056)

Slow release fertilizer tablets (optional)

Aluminum identification tags (optional)

APPENDIX 2

Estimated cost of planting both sides of one mile of stream with willow cuttings.

Rootone-F for 1,056 seedlings - 7 ounces @ $35

Salary (1) GS-07 to supervise volunteers for 1 day = $60

TOTAL - $95 or approximately $100 per mile

Assumptions:

- The equipment required is already available in district supplies.
- Labor costs are nonexistent because this methodology would utilize boy scouts or a similar community service group.
- Adequate protection is, or has been, provided to plantings.

APPENDIX 3

Sources of bare root or containerized willow stocks from Federal, State, or private nurseries in the intermountain region.[1/]

Organization/Company	Address	Cost / Unit[2/]
	UTAH	
Utah Forestry & Fire Control State Seedling Nursery	Draper, Utah 84020	$15-$20/100
Native Plants	9180 South Wasatch Blvd. Sandy, Utah 84092	NA
	IDAHO	
U.S.D.A. Forest Service Lucky Peak Nursery	c/o Idaho City Stage Boise, Idaho 83706	NA
U.S. Forest Service Cour D'Alene Nursery	3600 Nursery Road Cour D'Alene, Idaho 83814	NA
Idaho Dept. of Lands	c/o University of Idaho Forest Nursery Moscow, Idaho 93943 (208) 885-7952	$18/100
Fantasy Farms	P O Box 157 Peck, Idaho 83545 (208) 486-6481	NA
	MONTANA	
Willis Herron Montana Div. of Forestry	Missoula, Montana (406) 728-4300	$12/100
Lawyer's Nursery	Plains, Montana 59859 (406) 826-3881	NA
	NEVADA	
Nevada State Div. of Forestry	Washoe Nursery 885 Eastlake Blvd. Carson City, Nevada (702) 849-0213	$20/100

1/ Additional sources may be available in your area. Contact the BLM State Office, Forest Service Supervisor's Office and local directories.

2/ Cost estimates were obtained in October, 1982. Prices or supplies are subject to change.

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